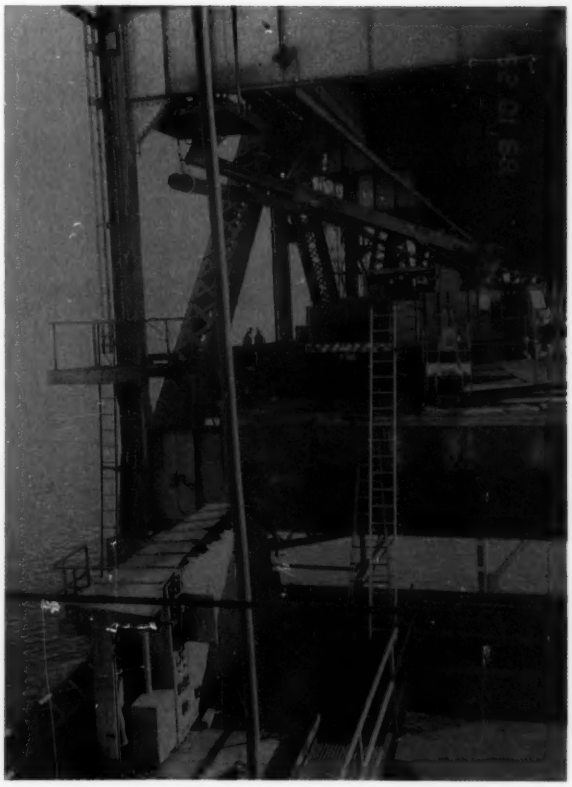
NAVY CIVIL Engineer
Spring/Summer/Fall 1990

Disaster Recovery Issue



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Front Cover: The aftermaths of Hurrican Hugo and the San Francisco earthquake. Clockwise from top right: Repair work underway on the San Francisco-Oakland Bay Bridge (suspended pipe is the Navy water supply line from east bay); large trees uprooted at the entrance of the Charleston Naval Base's headquarters building; and Seabees clear debris at the south end of the Charleston Naval Base. Bridge photo by LT Albert E. Spencer, CEC, USN. Charleston photos by PH2 Tom Petry.

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Speaking from Topside

We hear a lot these days about Total Quality Leadership. What is TQL all about, anyway? Why is the Naval Facilities Engineering Command involved? And what do we expect to come out of this involvement? These are all valid questions, because NAVFAC is strongly emphasizing quality improvement principles as part of our normal business. During these times when there are not enough dollars to go around, it is important that we each understand what TQL is all about and what we're investing in.

Total Quality Leadership is an effective, comprehensive management approach that has proven extremely effective in both the United States and Japan in manufacturing, services, and construction. It permeates every aspect of the organization and *makes quality the primary objective in all that we do*. In TQL, people at all levels of the organization work as a cohesive team to increase customer satisfaction by continuously improving performance.

If you have not yet been personally involved in a TQL effort, you might wonder what is so special about it that it has people excited. First, let me say that TQL is *not* a cookbook solution to management problems. Neither is it a form of "black magic." Rather, it is a set of tools which must be used over time to make a sustained difference in outcomes. More than anything else, TQL is a mind set, an attitude toward doing business. It is a commitment to applying certain business principles routinely in our everyday work place in our everyday jobs.

TQL incorporates a wide variety of common sense principles, but the more important ones include:

- Customer satisfaction—each of us has customers who depend upon our efforts to satisfy some need. It's our job to find a way to do so.
- Problem prevention—avoiding a problem beats solving one.
- Continuous process improvement—always seek a better way of doing business.
- Teamwork—TQL is an all hands matter, from the top to the bottom of the organization. It is essential that we work together for the common good—without teamwork there is no organization!
- Innovation—originate ideas for producing better products and services.

How many times have you heard someone say, out of frustration, "Why do we do it that way? We could do a much better job around here if we weren't constrained by these ridiculous rules! But, nobody listens to me." Well, the basic premise on which TQL is based is that *each* and *every* person in the organization knows best how to improve the product or service that they provide. Therefore, people at all levels in the organization are encouraged to initiate improvements and take ownership in making sure they happen. The command climate under TQL is positive and welcomes every opportunity to improve the way we operate. We don't wait for opportunity to come knock on our door, we seek it out and *create our opportunities for improvement.*

RADM A. Kent Riffey, CEC, USN

How is NAVFAC implementing TQL? It is being implemented concurrently across the command—Engineering Field Divisions, Construction Battalion Centers, the Naval Civil Engineering Laboratory, the Naval Energy and Environmental Support Activity, Public Works Centers, and at Headquarters. Most of the top and middle leadership has been formally trained in the basics of TQL. "Awareness" training has been provided to several thousand of our people and will continue until virtually all of our work force has been trained. Commands have identified certain processes that demand early attention for improvement, those people closest to the action have come up with ways for improvement, and changes have been made. Further, commands are encouraging small organizational units and individuals to initiate improvements. There is genuine enthusiasm for TQL and we have seen some very positive results.

The Construction Industry Institute recently surveyed 142 individuals from 19 contractor firms and owners regarding the importance of TQL. Their conclusion: "Companies must institute total quality management or become noncompetitive in the national and international construction and engineering markets for the next five to ten years." There's a lesson here for us, as well. Let's each one of us make a commitment to these principles. You *can* make a difference!

A. KENT RIFFEY
Rear Admiral, CEC, USN
Vice Commander,
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and
Deputy Chief of Civil Engineers

A Special Look at the Navy's Disaster Recovery Efforts in Charleston After Hurricane Hugo and in San Francisco After the Loma Prieta Earthquake

On Sept. 14, 1989, Hurricane Hugo stormed through Charleston, S.C., leaving death and destruction in its wake. One month later, on Oct. 17, the Loma Prieta earthquake rocked the San Francisco, Calif., area. The Charleston naval installations sustained $190 million in damages. San Francisco naval installations fared better, receiving moderate damage.

On the one-year anniversary of the hurricane and the earthquake, the *Navy Civil Engineer* magazine takes a look at the Navy's response to these disasters. This special issue examines the damage done, the development of strategies for recovery, and lessons learned in disaster recovery at naval installations in Charleston and San Francisco. ❑

Top photo: The fire chief at Naval Station, Treasure Island inspects water pressure on a 5-inch fire hose. Three 5-inch hoses provided water to Treasure Island from reservoirs while the main line was checked for leaks after the San Francisco earthquake. (Photo by LT Albert E. Spencer, CEC, USN)

Bottom photo: Chain-link security fences at the Charleston Naval Base caught debris from Hurricane Hugo. (Photo by PH2 Tom Petry)

Hurricane Hugo and the Navy

The Navy responded quickly to restore normalcy after one of the 10 worst hurricanes of the century.

By LCDR Thomas S. Hollinberger, CEC, USN

On Sept. 14, 1989, Tropical Depression 11, spinning in the Atlantic Ocean 700 miles east of Barbados, was officially declared a hurricane. It was named Hugo—French for "heart and mind." Nine days later, Hugo was gone. But remaining were the violent images of nature at her very worst.

Winds at 135 mph, 10 to 20 inches of rain, and a 15-foot tidal surge began cutting a path across the eastern Caribbean on Sept. 17. Antigua, the British Virgin Islands, Guadeloupe, Montserrat, Puerto Rico, Saint Kitts, the U.S. Virgin Islands...26 dead, more than 50,000 homeless.

• **Wednesday, 10:30 p.m., Sept. 20.** The National Weather Service predicted that Hugo (now a Category 2 hurricane, with winds up to 110 mph) would make landfall somewhere in a 100 mile stretch immediately south of Charleston, between midnight and dawn Friday. Unfortunately, this prediction was low by 100 miles and late by five hours.

• **Thursday morning, Sept. 21.** One hundred fifty thousand people evacuated the Charleston area. The people who stayed frantically braced their homes, businesses, and themselves for what would become a Category 4 (winds more than 130 mph) hurricane...the strongest ever to approach the Carolina coast.

• **Friday, 12:01 a.m., Sept. 22.** Five hours ahead of schedule, Hugo marched into the Charleston Harbor, and the eye passed over the city for about 30 minutes. Remaining residents peered out at the first half of a nightmare.

Utilities and other "permanent" fixtures at the Charleston Naval Base waterfront were devastated.

Photo by PH2 Tom Patry

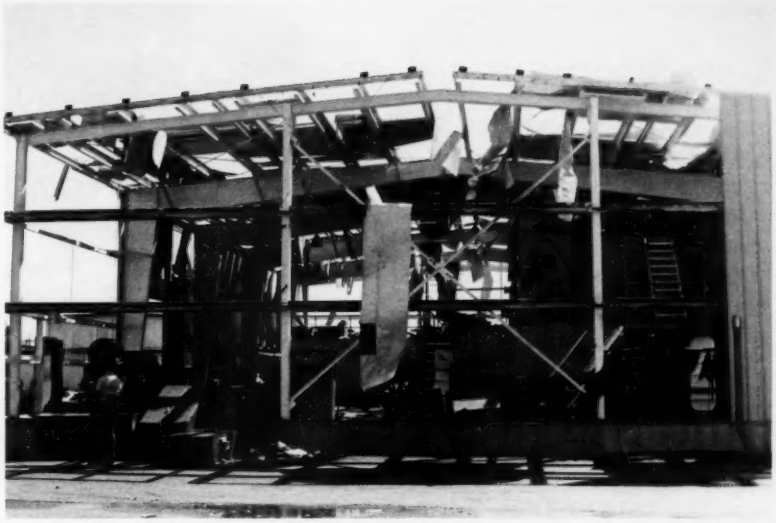
Throughout the early Friday morning hours, in South Carolina alone, 26 people were killed, and $5.9 billion in damage was done, amounting to $1,686 for every man, woman and child in the state. In the Charleston area, 64,500 people huddled in emergency shelters, 66,000 homes were destroyed or damaged, and 75 percent of the Francis Marion National Forest (the largest on the East Coast) was blown down.

At the Charleston military bases, no one was killed or seriously injured, 4,600 housing units were damaged, and 940 industrial/operational buildings were damaged. They will cost $175 million to repair.

During the months after Hugo, thousands in the Naval Facilities Engineering Command/Civil Engineer Corps/public works/Seabee family were called upon for their special talents. They demonstrated that, as an organization, they were well prepared and capable of restoring normalcy in the wake of a major disaster: one of the 10 worst hurricanes of the century.

Restoration of normalcy took sheer will and perseverance, and tough lessons were learned. This article reviews the NAVFAC/CEC/public works/Seabee response to Hugo from the Charleston point of view. It spells out actions taken and lessons learned during the first few weeks when quick decisions had to be made—the sort of decisions and circumstances that aren't usually covered in disaster preparedness instructions or hurricane exercises.

This article has a three-part approach: damage assessment, immediate actions, and recovery strategy.



Pre-engineered buildings fared well until their envelope was compromised, usually at the corner or gable flashing. Then it was all over. This was the Fleet Mine Warfare Training Center at the Charleston Naval Base. Photo by PH2 Tom Petry

Damage Assessment: Eating the Elephant

The effects of Hugo had to be seen to be believed. The scale of the destruction was incomprehensible at first—no limits and no pattern to the damage. So, how to attack the problem? Like eating the elephant—one bite at a time.

First, the Southern Division, Naval Facilities Engineering Command assessed the damage to its prime asset, its people. To do that, SOUTHDIV had to be able to communicate with them.

Because of the buried, fiberoptic cables, the commercial telephone system in the Charleston area fared well compared to other utilities. However, calling SOUTHDIV employees and exercising recall procedures were hampered because the SOUTHDIV building was without power and the battery backup for the building's phone exchange would last only eight hours. But, you guessed it, the pay phones in the building and cellular phones worked just fine!

Radio stations were an essential link to the outside world and were used for announcing information to the public. The Charleston Naval Shipyard used local radio stations to put out the word regarding work status. But the airwaves were just too crowded to announce work plans for every tenant command in Charleston.

The solution is an "unless otherwise directed" plan that will work without phones, radio or TV. Before the hurricane season starts, guesstimate the required mix of personnel, develop a response team with plenty of depth (since some essential people will have personal tragedies they must attend to), and pick a time and place for employees to report for duty unless otherwise directed.

Given the success of commercial phone systems in Charleston, a hot line number might be a viable alternative to get out information to the less essential personnel. But two physically separated hot line numbers are necessary in case one is destroyed in the storm.

To give some perspective on how disruptive a Category 4 hurricane can be to your ability to muster a work force, one week after Hugo hit, 25

LCDR Hollinberger is the deputy for facilities acquisition at the Southern Division, Naval Facilities Engineering Command in Charleston, S.C.

percent of SOUTHDIV's personnel were still unable to report to work for such reasons as no home, no car, no phone, no gas, no water, or no food. Dual income households and single parent families were hit hard when public schools were closed for three weeks and day care centers were closed until whenever power and water were restored. SOUTHDIV and other commands set up ad hoc day care centers in conference rooms and cafeterias for their personnel with children.

As the work force pulled itself together, two main efforts began—immediate fixes and damage assessment.

Damage assessment is an iterative process—the more you do it, the better you become at it. At first it's anything but precise. It's hiking into a housing area with a raincoat, flashlight and clipboard since the roads are blocked by fallen trees.

It's hand sketches with carbon paper since copy machines are a rare commodity. It's the tough, engineering decision on how to expediently dry-in a building whose roof is half-blown away and may no longer be structurally sound. Gradually, damage assessment became a constantly refined cycle of making discoveries, estimating, setting priorities, and keeping the major claimant informed of the dollars and resources needed.

With only a limited number of people, a balance must be struck between immediate fixes and damage assessment. Efforts to solve immediate problems will stall out or lose direction if damage assessment teams haven't done the advance work necessary to rank *the whole slate* of damage that exists, or haven't provided estimates necessary to start the flow of recovery dollars and resources from the major claimant.

Fielding a damage assessment team in Charleston had all the typical logistic problems, and some additional hurdles were encountered. Getting to the damaged areas in spite of fallen trees and getting into and on top of buildings that had been secured before the storm was a challenge. Documenting the damage became a sizable task.

Even in disaster recovery, paperwork counts. Current base maps and standard forms for documenting damage were invaluable. They allowed out-of-towners to come in and immediately be productive as damage assessors. But, more importantly, the standard forms allowed public works offices to quickly develop computerized data bases of the damage. Intelligent decisions about priorities and contracting strategies could then be made.

Uprooted trees were a common sight after Hugo at the Charleston Naval Weapons Station. This tree is in the officers' housing area. Photo by Naval Weapons Station Charleston

The damage to the Navy in Charleston was:

- Buildings: $121 million
- Family housing: $25 million
- Waterfront: $23 million
- Utilities: $12 million
- Road and grounds: $9 million

Typical causes of the damage were:

- Rain after the hurricane
- Wind forces on roofs, siding, windows, trees and aboveground utilities
- Tree strikes on buildings, above ground utilities and vehicles
- Boats and barges breaking free and hitting waterfront structures
- Flying debris

The resultant problems included:

- No access for emergency vehicles due to fallen trees
- No power because of downed power lines and utility company outages
- No water treatment or pressure because of no power
- Broken water lines due to uprooted trees
- Lack of undamaged pier space for the fleet once they returned to port
- Overwhelming volume of fallen trees and garbage
- Getting trash delivered to the trash-to-steam plant which produces steam for the ships
- Mosquitoes and more mosquitoes

Immediate Fixes: Dig Out, Power Up, Dry In

Frankly, the first few days of recovery efforts did not require a lot of strategizing. It was apparent what had to be done, and there was plenty to do. For example, at the naval weapons station the events during the first several days proceeded this way:

Friday, 12:01 a.m.
Hugo hits.

Friday
Contacting employees and clearing roadways.

Saturday
Public works electrical crews began restoration.

Letter contracts were issued for emergency repairs and services.

Sunday
SOUTHDIV/public works department damage assessment teams began.

Seabee air detachments arrived and began clearing operations and electrical repairs.

Monday/Tuesday
More emergency generators arrived from the Naval Construction Battalion Center, Gulfport, Miss., and the Naval Energy and Environmental Support Activity in Port Hueneme, Calif.

From a broad perspective, restoring utilities (especially water) was the first order of business, closely followed by drying-in facilities to prevent further weather damage. The Seabees would soon be on board, cutting access routes, clearing debris, and making good use of the 100 chain saws purchased by the naval weapons station.

While the Seabees' safety record was admirable, folks in town were not as safety conscious. The bodily injuries inflicted on the townspeople by Hugo were minimal compared to the injuries the townspeople received during cleanup efforts. In the scramble to restore essential services to the Charleston naval installations, however, safety was constantly emphasized so it did not take a back seat by default.

Public works forces restored electrical distribution while Seabees repaired the secondary service drops to individual housing units. The public works forces' intimate knowledge of the on-base utility systems proved invaluable. They coordinated closely with regional power companies so the bases would be ready to receive commercial power when it was available. Knowing when the commercial power would be available helped in assigning the public works electricians to the right areas of the base at the right pace. It was also critical for establishing the "emergency generator program."

Commercial power would not be available for about two weeks. This

Roofing: It's Time to Get on Top of the Problem

Rick Cook is a member of the Roofing Reliability Team at the Southern Division, Naval Facilities Engineering Command. After Hugo, Rick developed a computerized database of roofing damage assessment and a word-processed template which he used to write $2.4 million worth of letter contracts for roof repairs. Here are a few of his insights.

- Eighty percent of the Hugo repair costs were for roof or weather damage to building interiors.
- Roofing costs are a pittance compared to the value of material and equipment they protect. Thus, repairing roof damage quickly, to avoid rain damage to interiors, has a high return-on-investment.
- Problems started at edge details, penetrations and terminations. Factory Mutual's Loss Prevention Data I-49 and SMACNA'a Architectural Sheetmetal Manual are excellent references for appropriate roof details.
- Hurricane-smart design of roofs isn't enough. The roofs must be installed correctly.
- The Navy has allowed many different types of roofing systems over the years, so it is almost impossible to stock all the different "repair kits" necessary to quickly dry-in damaged roofs. Identifying the systems and maintaining and repairing them on a moment's notice is beyond the capabilities of most public works departments. ❑

Large sections of roofing were blown off during the hurricane.

Photo by PH2 Tom Petry

This was a small boat pier before Hugo hit. Photo by PH2 Tom Petry

created a demand for emergency generators well beyond the number of generators on hand.

Since there weren't any generators available on the local economy, NEESA and other naval installations responded with loaner equipment. By day seven, 65 percent of the naval base was on emergency generators. The allocation, maintenance and fueling of more than 40 emergency generators was labor intensive and required brokering by the public works officers.

It was not sufficient to simply power up mission essential functions. To quickly recover from a hurricane, you have to provide power, water and other necessities such as gas and food to the recovery workers. Two outstanding examples of fueling the recovery process were the expedient hookup of the naval base McDonald's and the naval weapons station commissary. With power off in the community, food was spoiling in refrigerators. Ice, food and a hot hamburger had very real, positive effects on the recovery efforts.

After Hugo hit, utility companies, private concerns, and the Navy were all scrambling to lock in contractors to help recovery efforts. The naval weapons station and shipyard public works issued letter contracts to contractors to perform such tasks as post-hurricane annual inspection summary, power pole setting and architect/engineer services for quick fixes.

The Charleston experience showed that most utility-related subcontractors are snatched up quickly by utility companies. Public works officers need to be ready to find and contract with utilities-related subcontractors just as fast.

Other contractors and subs in short supply were roofing, refuse/debris removal, logging pest control and general laborers to tack down plastic sheeting for temporary roof repairs. At the beginning of the hurricane season, public works officers should do abbreviated market surveys and keep a file of contacts and sample letter contracts.

Seabees at CBC Gulfport and CBC Port Hueneme began preparing to send air detachments to Charleston even before the hurricane made landfall, which led the Charleston Sunday newspaper to proclaim, "Seabees on way to aid in cleanup." It was only the second reference the newspaper had made to any out-of-town relief efforts (the first was the South Carolina National Guard).

A convoy of 47 pieces of heavy equipment arrived from Gulfport and was split between the air detachments from NMCB Five and 133. At the naval base, NMCB Five focused on roof repairs and quick dry-in of buildings. At the end of two weeks, they had repaired roofs and windows in 65 buildings. NMCB 133 managed the heavy equipment and supply support. They cut, cleared and hauled trees and debris at naval weapons station and the 2,700 unit housing complex. Base personnel were assigned to coordinate on-site logistics for the Seabees, and lined up material, equipment, and work assignments to keep the green machine rolling.

Construction Battalion Unit 412 had helped the naval base secure for the storm and then dispersed their equipment and personnel. During the storm a group of CBU 412 personnel who were pre-positioned at the naval hospital served as stretcher bearers after the elevator penthouse was blown away at the height of the storm. At dawn, the CBU teams pre-positioned in the housing areas began cutting their way back to the base, picking up personnel as they went. By 11 a.m., after a rough night and a morning of clearing debris, CBU 412 mustered and began replacing five miles of chain link security fence. By the way, chain link fence was a great debris catcher, but the chain link fence with visual screening usually just blew over.

Two 750 kilowatt mobile utilities support equipment generators were delivered by two four-man NEESA teams. The teams positioned and set up the units, then set up sustained generator watches to cover all the emergency generators on the base. When five warehouses full of Naval Electronic Systems Command electronics gear were destroyed, leasing became the only viable alternative to

store the salvageable equipment quickly. In addition to being quick, the leasing solution could last as long as necessary. SOUTHDIV real estate specialists had leased similar warehouse space less than one month before. They contacted the second lowest bidder to see if his warehouse was intact and whether he would be willing to lease it for this new requirement. After proper justification, and in accordance with the P-73 (Real Estate Procedural Manual), the warehouse was leased on day number five.

Similar to utilities subcontractors, leased spaces go quickly. After the Navy had signed the warehouse lease, several other private concerns approached SOUTHDIV, willing to pay much more than our lease amount just to get that space. Public works officers should conduct market surveys and stay in contact with local commercial real estate agents and developers so they will know what is available in the event of an emergency. Engineering field division real estate specialists will probably do the contractual work, but just knowing what's available is the critical first step.

One last immediate action should be mentioned: handling housing occupants. Hurricane preparations had paid off with no major injuries or fatalities during the storm. A one-stop family relief center was fully functioning at the Navy housing area's elementary school.

Navy Relief was issuing more than $700,000 in grants. But still, the prospect of two weeks without power was more than an inconvenience to the occupants. It created hardships the Navy commands just couldn't mitigate...and still be able to perform recovery operations. As a result, housing occupants were given a realistic assessment of the situation and were asked to "go visit relatives if possible." Reducing the demand for base services was the only way to get the breathing room necessary for an orderly recovery.

Coping with a Disaster at Naval Hospital Charleston

Lieutenant Brad Campbell, CEC, USNR, was the staff civil engineer at the naval hospital in Charleston. He and the 12-person public works staff worked five round-the-clock days to keep the hospital open during and after the hurricane. Based on that experience, here are his views on lessons learned in hospital design.

The naval hospital was the only hospital in Charleston to remain fully functional throughout the storm. This was not just a victory in the man-versus-nature category; it also was an all hands effort in a man-versus-design struggle.

Many of the problems tackled by the public works staff stemmed from the design of the 10-story hospital building. Portions of the elevator penthouse were blown away at the height of the storm. (Wind forces were 1-1/2 times stronger at the top of the building than on the ground.) The exposed elevator equipment was then blasted with a matting of pine needles and debris. As wall panels were sucked out of the penthouse, all the electronic controls of the public address system, the nurse call system and the fire alarms were destroyed. A third of the 1-1/2 inch roofing aggregate blew off, destroying a parking lot full of windshields, including the ambulances'. The standing water on the penthouse deck leaked into the 10th floor operating rooms and intensive care unit. The water-soaked life support equipment was repaired and tested for safety by the public works staff.

There were problems because the operating rooms and intensive care unit were located on the 10th floor. Patients had to be carried on stretchers up 10 floors because the elevators did not work.

Bucket brigades were needed to get water to the 10th floor operating rooms and intensive care unit when city water became unpotable. And ventilation was lost when the operating room ductwork caved in due to the pressure differentials.

The emergency generation system, as designed, didn't cover essentials such as air conditioning, a necessity in a 10-story building with inoperable, sealed windows. Floor fans, run on portable generators, were set up to cool the 300 nursing home patients who had been evacuated to the hospital before the storm. The blood refrigerator had not been hooked up to the emergency generator system. It was connected to emergency power in the dark the morning after the storm.

Other annoyances demanded attention as the pace of hospital operations picked up the next morning. The extensive glass "storefront" entrance was swept up, the perimeter fence was repaired and the corpsmen barracks windows were boarded up to stop looting. Eventually, Marines from Parris Island were called in to patrol the compound. ❑

Recovery Strategy: The Right Tool for the Right Job

The initial damage assessment effort provided the information necessary to develop a coherent recovery strategy. Four facts of life drove that strategy:

1. A great number of buildings were laid open, with the potential for additional weather damage.
2. Mission critical facilities (piers, missile production facilities) were shut down.
3. The scope of damage was enormous and not initially obvious.
4. There were limited resources to administer/manage the recovery effort.

Tools available to complete the broad range of tasks included:

- In-house public works forces
- Out-of-town public works forces
- Seabees
- Leasing
- Service contracts
- Letter contracts
- Job order contracts
- Firm-fixed price contracts
- Cost plus contracts

These tools are effective in different ways. Some are quick starters; others take time to bring on-line. Some can accomplish a limited volume of work; others can be expanded to cover unforeseen problems. Blending together the right tools for the right job, and covering the full extent of the damage was done as follows.

In-house public works forces. First on the scene, public works forces restored essential utilities and services. They also became the core of knowledge and direction for the second wave of recovery efforts.

Out-of-town public works forces. Many Navy commands throughout the Southeast were preparing for Hugo. Those that were spared sent their resources to Charleston's aid. Utility crews, sheet metal and carpentry teams (with materials and equipment) were sent from commands including Norfolk, Jacksonville, Kings Bay, Puget Sound and Mare Island. Lodging, food and support for these workers were a major concern.

Seabees. Two air detachments were flown in from both coasts. Along with CBU 412, they were used for quick dry-in of facilities, secondary power restoration, fence replacement, and cutting, clearing and hauling operations. MUSE units and other emergency generators were run by NEESA teams.

Leasing. To quickly replace large space for long periods of time, leasing was the logical choice. Engineering field division real estate specialists replaced 50,000 square feet of warehouse space in five days.

Service contracts. Existing service contracts were expanded, using letter contracts, to perform recovery tasks. Paving contractors hauled 2,500 12-ton dump loads of debris. Custodial contractors shifted to cleaning up interior water damage. Grounds maintenance contractors focused on clearing and hauling. The refuse contractor was paid to increase pickups. Later, small purchase contractors were used for cleanup and stump grinding.

Letter contracts. With extensive roof damage throughout the bases, immediate temporary fixes were required to protect the building interiors, including some valuable equipment and supplies. Authority to use other than "full and open competition" and to use letter contracts was immediately obtained from NAVFAC headquarters and the Office of the Assistant Secretary of the Navy. With this authority, work announcements were posted on bulletin boards, firms

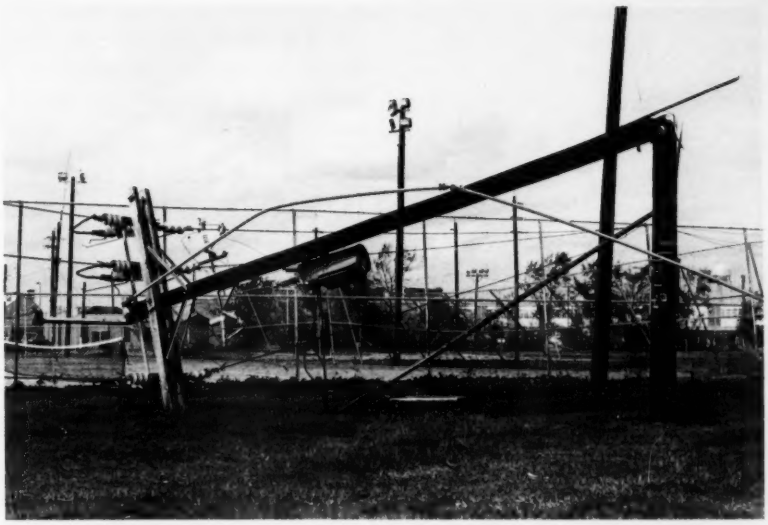
A berthing barge used broke its mooring and ended up 150 yards inland.
Photo by PH2 Tom Petry

on existing bidders lists were contacted, and firms which called in looking for ways to help were considered for contract work.

Letter contracts were issued on the spot, and firms were making temporary roof repairs within hours. In general, these two-page letter contracts were used for emergent roof repairs and services like setting 300 power poles in two weeks, logging, and conducting facility inspections. This amounted to about $12 million and lasted through the first three months. Once underway, the scope and price were defined and negotiated and the letter contract became just another firm-fixed price contract. This process was a major effort for the 120 letter contracts that were awarded.

Job order contracts. Though not exclusively a tool for emergency situations, the job order contract was selected to perform the sort of smaller repair work that public works shops would do...if there were enough of them. Since a job order contract was not in place when Hugo hit, a new contract had to be awarded, using request for proposal procedures. Once it was in place, it provided a menu of unit-priced work items. To develop and issue an individual job order under this blanket contract, the government representative negotiates the quantity of work items desired (square feet of floor tile, squares of roofing). The Hugo job order contract will complete approximately $2 million in repairs and is managed by four government representatives.

Firm-fixed price contracts. There will always be a place for firm-fixed price contracts, even in the wake of hurricanes. Some tasks like paving, fencing, fender piling, or re-roofing can be quickly designed and packaged as firm-fixed price contracts. Seventeen million dollars of Hugo repairs were performed under firm-fixed price contracts. This firm-fixed price effort had these benefits:



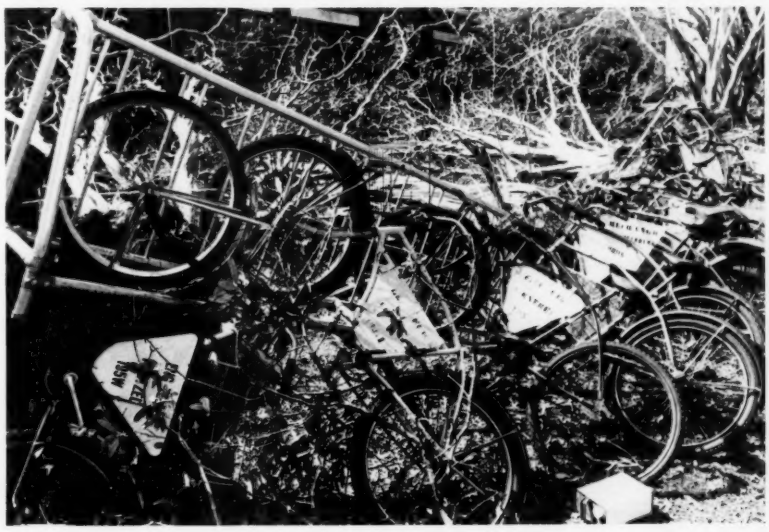
The force of the winds broke this power pole near the tennis courts on the south end of the naval base. Photo by PH2 Tom Petry

- It kept the Navy apprised of the bidding climate and availability of labor.

- These "free market" barometers (and the job order contract) were useful as foils or safety valves if one of the cost plus efforts bogged down.

Cost plus/award fee contracts (well documented in NAVFAC P-398, Cost Reimbursement Construction Contract Manual). There wasn't enough time to scope, design, and bid all the repair work on a firm-fixed price basis. Even if the time was available, some projects were simply "unscopeable" until someone could get in and remove debris. To share the risk of uncertain scopes and to shorten de-

Bicycles did not escape the hurricane. Photo by PH2 Tom Petry



sign and construction schedules, the cost plus type of contract was selected (as allowed in Federal Acquisition Regulations 16.305). A/E firms were matched with major construction firms for each of four Navy and Air Force installations. A/Es and contractors were selected though less-than-full-and-open competition as allowed by FAR 6.302-2. The scope of these contracts had some overlap to provide a second source as backup if necessary.

After the cost plus mechanism was selected, the fee structure had to be selected—either fixed-fee, incentive-fee, or award-fee. The award-fee approach was chosen to get the contractor's management attention and to attain excellence. The award-fee is better described as a reward-fee for performance on an agreed upon scorecard which can include such items as safety, cost-control, quality, and schedule. Good performance on the scorecard earns the contractor the reward, for example, a percentage of the basic cost of construction.

Appraising a contractor's performance requires a formal, management intensive effort in addition to the normal construction representative efforts because the government must now be concerned with cost effectiveness of the contractor, in addition to a quality product. Agreeing upon the basic cost of construction is also a major continuing effort as the scope of work firms up as work progresses.

Four cost plus/award fee contracts, awarded between October and December, performed $90 million of work in place in nine months, employed a contractor work force of 2,000, and was managed by a separate officer in charge of construction organization of 80 personnel through September 1990.

MILCON. To round out the recovery strategy, 14 facilities ($55 million) will be replaced through MILCON projects under a special appropriation in FY 90 and FY 91. ❑

Successes in Fender System Designs

Chip Stehmeyer is a supervisory structural engineer in the Structural Geotechnical Branch of the Design Division in the Southern Division, Naval Facilities Engineering Command. Here is his summary of the pier damage sustained at Naval Weapons Station Charleston.

Immediately following Hurricane Hugo, the Southern Division was tasked to inspect all piers to ensure that the sortied ships could return and dock safely, so the sailors aboard could be reunited with their families. The inspections were completed two days after the storm by Southern Division's Structural Geotechnical Branch members.

At piers where ships were moored during the storm, the fender systems were badly damaged or destroyed. Timber fender systems were destroyed; the majority of the steel fender systems were bent or twisted but withstood the winds and storm surge without total failure.

Pier Zulu's resilient foam-filled fender systems, however, performed admirably with large Navy combatant ships moored against them. The 7 foot diameter by 14 foot long netless-style foam-filled fenders protected the sides of the ships as well as the pier. The fenders were fully functional after the storm.

The most critical waterfront casualty was damage to the naval weapons station's Pier Bravo, Charleston's major combatant weapons handling pier. It sustained major fender damage to the north side of the pier. The weapons station requested immediate help in repairing Pier Bravo. Southern Division's in-house engineers in the Design Division responded quickly, providing a complete design package in just two weeks.

The design included a retrofit of Pier Bravo with prestressed concrete fender piles, precast concrete bearing panels and foam-filled fenders. Bids were taken from a selected bidders two weeks after the design was completed, and a construction contract was awarded two days after that. The contract award price was approximately $1.36 million for the north and south sides of the pier. The estimated replacement cost for a timber system, exactly like the system which failed during the storm, was $1.2 million. The minor additional expense to replace the timber system with the superior foam-filled fender system is easily justified by the reduced yearly maintenance costs.

The north side construction was completed in February 1990, and the south side construction was completed in August 1990. ❑

Lessons Learned in Recovering from Hugo

The minimal injury and loss of life for the Navy in Charleston during Hurricane Hugo shows that our preparation skills are reasonably well developed. The preceding articles discussed some of the tough lessons learned about our response and recovery skills. They include:

1. When the arrival of the hurricane is imminent, cut off the power in order to minimize damage and life-threatening situations.

2. Assess the damage to your prime asset—your people—after the storm.

3. Set up "unless otherwise directed" recall procedures before the storm.

4. Make damage assessment team assignments before the storm.

5. Get phones that work even when the power is out.

6. Have two physically separated hot lines.

7. Provide child care, gasoline and meals, if necessary, for your employees so they can return to work. Don't forget lodging, food and support for out-of-towners.

8. Balance your limited resources between damage assessment and immediate fixes.

9. Use damage assessments to create a data base of all damage for setting priorities and using resources.

10. Keep plenty of current small base maps, utilities as-builts, standard damage assessment forms and phone listings in the hurricane locker.

11. General plan of attack:
- Clearing emergency access
- Utilities restoration (especially potable water)
- Drying-in facilities
- Debris removal

12. Popular or hard to get work-related items: confirmation of potable water, truly portable generators, plastic sheeting, roofing felt, chain saws with two cycle oil, plywood, roofing mastic, shingles, self-tapping screws with neoprene washers, corrugated sheet metal, ladders, two-man motorized lift capability and extension cords.

13. Popular or hard to get personal-related items: confirmation of potable water, truly portable generators, day care, disposable diapers, cash (automated teller machines didn't have backup power and checks and credit cards couldn't be verified), gas (local stations didn't have backup power), hot showers, ice, LP gas, kerosene and someone to fix the numerous flat tires.

14. Use Seabees and out-of-town help to augment and multiply the effect of public works forces who know the lay of the land.

15. Request additional emergency generators from other installations and appoint an emergency generator czar to manage their use.

16. Appoint a roofing czar to manage repairs to the many types and locations of roofs.

17. Don't forget to power up support functions (commissaries, gas stations, restaurants, and galleys) quickly to help "fuel" recovery efforts.

18. Quickly contract for high demand trades like roofing, refuse/debris removal, logging, pest control and any type of utilities work. Time is of the essence. Public works officers should keep a file of contacts and use letter contracts to lock in their services.

19. Seabees work as advertised, but close coordination with base supply is essential. Assign base personnel to coordinate logistics and workload.

20. Consider leasing with the help of engineering field division real estate specialists as an option for replacing large spaces quickly for a long-term requirement. Time is of the essence and local sources should be on file.

21. Invite housing occupants to go visit relatives until things return to normal.

22. Use the damage assessment data base when possible to develop a recovery strategy and seek the contracting authority necessary to implement it. ❑

Disaster Relief Support Provided by the Naval Energy and Environmental Support Activity

By Pamela S. Latimer

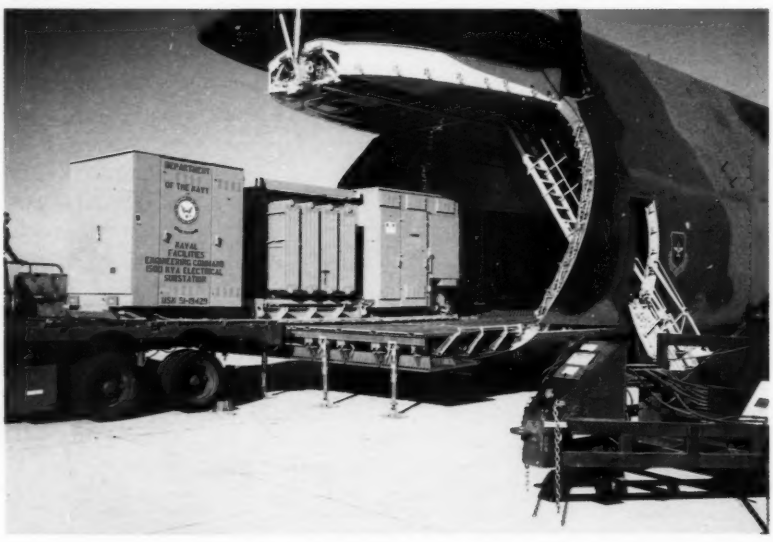
NEESA responded when Hurrican Hugo devastated Charleston and Puerto Rico and when the earthquake hit San Francisco.

Emergency support was provided through the Mobile Utilities Support Equipment program, or MUSE program, when Hurricane Hugo devastated the Puerto Rico and Charleston, S.C., areas last September and following the earthquake in the San Francisco, Calif., area last October.

The MUSE program is administered for the Naval Facilities Engineering Command by the Naval Energy and Environmental Support Activity in Port Hueneme, Calif. This program provides mobile utility

Pamela S. Latimer is the public affairs officer at the Naval Energy and Environmental Support Activity in Port Hueneme, Calif.

A MUSE 1,500 ampere substation is loaded in a C-5 aircraft for shipment to Puerto Rico.



modules consisting of power generators, steam plants, electrical substations and water treatment plants. This equipment is deployed worldwide to provide emergency or short-term utilities support.

Puerto Rico

When Hugo hit the naval station at Roosevelt Roads, Puerto Rico, all electrical power supplied by the commercial utility company was lost. In addition, much of the base distribution system was destroyed.

The Puerto Rico Power Authority estimated that power might be unavailable for up to three months. The naval station requested that we provide 10 750 kilowatt generators and two 1,500 kilovolt ampere substations.

The equipment was airlifted from Naval Air Station Point Mugu, Calif., and was accompanied by 11 NEESA MUSE Seabee technicians.

The people at U.S. Naval Station Roosevelt Roads, Puerto Rico, showed their appreciation for MUSE support.

Four days after the request was submitted, the equipment was in Puerto Rico. Once there, the equipment was moved to various sites and installed.

The MUSE technicians worked more than 45 hours straight to get the equipment connected and operational. They then operated and maintained the equipment, which fed power to the dependent housing area, bachelor enlisted and officer housing, and the station hospital.

The equipment was operated for 20 days until normal commercial power was restored. During this time it operated more than 1,100 hours and generated more than 495 thousand kilowatt hours of electrical power.

Charleston, S.C.

NEESA also provided emergency assistance to the Charleston area in the wake of Hugo's visit, which left numerous naval activities without electrical power. When Hugo hit the Charleston area, all electrical power was interrupted. Naval station personnel, acting as the central coordinating point for all area naval activities, requested MUSE support. Six units were shipped to Charleston — two 1,500 and one 2,500 kilovolt ampere substations, and three 750 kilowatt generators. These units were connected at several large facilities to restore electrical service. Seven Seabee MUSE technicians also went to Charleston to install and operate the MUSE equipment.

The MUSE team also worked closely with public works personnel to determine what size generators were required at key base facilities, to establish safety policies and to repair the hundreds of generators scattered around the area. They worked around-the-clock to answer emergency calls and operate the equipment.

Electrical power was provided to the boiler plant, enlisted club, credit union and the barracks at the naval station, as well as the naval shipyard, and Fleet Mine Warfare Training Center.

The MUSE team worked for 11 days until commercial power was restored. This was in addition to the assistance provided to the public works department.

San Francisco, Calif., earthquake

When the earthquake hit the San Francisco area last October, commercial electrical power to Naval Station, Treasure Island was interrupted. Although power was restored quickly, considerable concern existed that the power supply might be interrupted again due to the numerous aftershocks and the possibility that power cable insulation may have been damaged and weakened. Public Works Center San Francisco Bay personnel requested three MUSE generators for Treasure Island as a backup in case the cross bay cable feeding the station failed.

Three MUSE 750 kilowatt generators were trucked to the station. A three-man team from NEESA installed the equipment and instructed public works personnel on operations and maintenance. While this equipment was not put into service, it was ready to provide power to maintain essential station operations until restoration of commercial power. ❑

Earthquake Recovery at Naval Station, Treasure Island

By LTJG Cynthia O. Ringwall, CEC, USN
and
LT Albert E. Spencer, CEC, USN

It is late Tuesday afternoon. The World Series is about to get started when a earthquake measuring 7.1 on the Richter scale rocks one of the world's largest man-made island. You are the local civil engineer—what do you do?

This was not a training scenario. It was real life for the staff civil engineer and activity civil engineer assigned to Naval Station, Treasure Island and Navy Public Works Center San Francisco Bay.

Naval Station, Treasure Island sustained more damage than any of the other naval activities in the San Francisco Bay area. The naval station, located in the middle of San Francisco Bay, consists of two islands. One of the islands, Yerba Buena, is a 156-acre natural island and the anchorage point for the middle of the Oakland-San Francisco Bay Bridge. Yerba Buena Island sustained no damage in the Oct. 17, 1989, earthquake.

Treasure Island, the second island, is a man-made island of 403 acres completed in 1937. It is made of hydraulic fill on top of an old shoal that runs as deep as -18 feet mean low

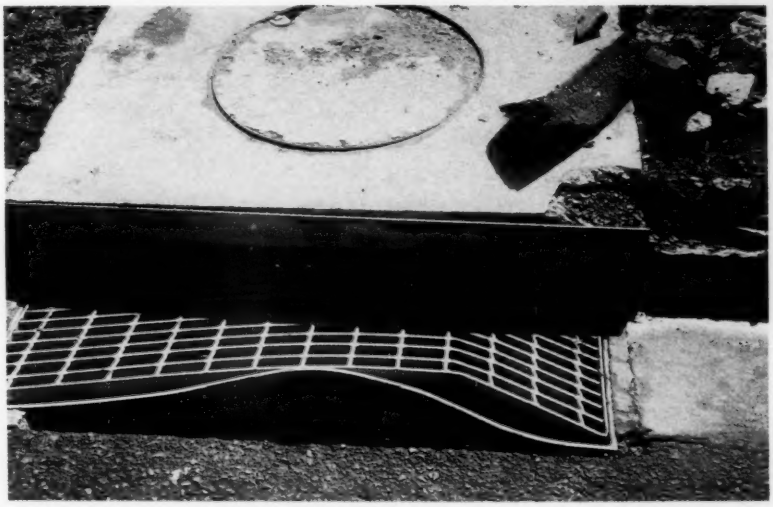
LTJG Cynthia O. Ringwall is the activity civil engineer at Naval Station, Treasure Island, and LT Albert E. Spencer is the staff civil engineer at the Navy Public Works Center San Francisco Bay.

NMCB Three personnel install a portable shower unit in the housing area. Photo by LT Albert E. Spencer

low water (MLLW). Underlying material is alluvial deposits with bedrock 300 feet below the surface. The island sustained minimal seismic acceleration and due to its geology, experienced a disproportionate amount of liquefaction.

Liquefaction is the failure of saturated, sandy soil. The soil loses its strength due to the increase in pore pressure and subsequent separation of soil particles. The soil essentially behaves like a liquid.

Recovery efforts were focused on evaluating resources to repair the damage, damage assessment, and coordinating repair efforts.



Deformed storm grate in the housing area. Photo by Tom Cuckler

Resource evaluation

Immediately after the earthquake, the first step to recovery was determining which naval station employees were available on the island and what their condition and capabilities were. As the earthquake occurred after regular work hours, the only facility work force remaining on the island was a small crew of mechanics under the supervision of a public works center pipe fitter foreman, three staff civil engineers and the fire department crew.

The authors of this article, who will be referred to throughout as the ACE (activity civil engineer) and SCE (staff civil engineer), also had departed. The ACE, however, immediately returned to the nearest base, Naval Air Station Alameda, in response to a general recall generated by the PWC. The SCE was unable to return to Treasure Island until the next day because of the collapsed Bay Bridge and the confusion resulting from the burning Marina District on the San Francisco side of the bay.

Initial communications on Treasure Island were hampered by a new phone system installed only four days earlier, which changed all the old phone numbers. Later, once the new telephone numbers were known, the expanded capabilities of the new digital system actually enhanced communications. Additionally, the PWC had radios with frequencies assigned according to department instead of geographic area. Unfortunately, this radio system did not allow the SCE access to the frequencies. Repair materials and equipment such as generators and portable light poles were also scarce, so equipment from Reserve Naval Mobile Construction Battalion Two was quickly put into service.

Actions taken within the first 12 hours of the earthquake set the pace and ultimately determined the success of the recovery effort. Workers quickly secured the natural gas on the island and the water at the reservoirs to prevent further loss. This quick response reduced the potential for fire and eliminated loss of water through breaks in the system. Both water lines supplying Treasure Island were out of commission—one because of the break in the bridge, the other, on the San Francisco side, due to a loss of electrical power.

The ACE on the Oakland side of the bay set up boat shuttles through the naval stations' Port Services to transport additional workers and materials to Treasure Island. Officers in the PWC Utility Control Center at the Naval Supply Center in Oakland obtained additional crews, heavy equipment and materials from up and down the West Coast. Repairs could not have been made without the materials from other parts of California, as supplies available in San Francisco could not satisfy the demand.

Repair efforts

Repair efforts began the next day.

The water distribution system dates back to the 1940s and installation of a replacement system had just begun before the quake. Isolation of damaged sections was difficult because valves were not functioning properly and there were many undocumented cross connections between the fire and domestic water systems.

The lack of water made leaks difficult to find, since sand boils (result-

ing from liquefaction) also look like ruptures in a water line. Holes were initially dug to find broken pipes that weren't there. With no water service to the island, there was concern about using the little water left in the reservoirs to locate leaks, which would deplete the supply for the water in fire and portable tanks placed around the station.

Water was restored within one week to housing and within two weeks to the majority of the base. More than 175 major water leaks were repaired. Gas was restored to homes in a little over a week after the earthquake.

Electrical service on station suffered only minor damage and power was restored within six hours.

Families in the 1,066 housing units on Treasure Island were without water and gas for cooking, and there was no water for the base's sewerage systems. Restoration to these units and the bachelor quarters became the top priority.

Meals were served to all island residents from the galley and the Morale, Welfare and Recreation restaurant. Portable chemical toilets were placed around the island and Seabees set up portable shower units in the housing area. Water buffaloes were brought in, set up and maintained around-the-clock in housing by RNMCB Two.

Along with making utility repairs, buildings were assessed for damage. The Western Division of the Naval Facilities Engineering Command inspected critical buildings identified by the SCE, and regularly talked with building occupants to keep them informed as to the condition of their buildings. Contracts were issued to provide detailed inspections of selected facilities.

Integrity of the seawall surrounding the island and the causeway connecting Treasure Island to Yerba Buena Island was another major concern. Settlement and cracking were readily visible. A portion of the seawall experienced rotational settlement and another area settled 18 inches. WESTDIV geotechnical and U.S. Geological Survey staff assessed the situation.

In retrospect, Treasure Island recovery workers did a good job responding to and recovering from the earthquake.

Early establishment of a local recovery control center on the island was critical to the success of the recovery effort. Local control was easily established because of the decentralization of the PWC to regional sites earlier in the year. Treasure Island essentially had its own public works department complete with site manager, activity civil engineer, planners, estimators, and about 50 trades people.

The local control center was staffed by the site manager, SCE, ACE and fire chief. Support was provided by the central PWC command center and the naval station command center, which worked with regional and national command centers. This allowed easy access to resources and freed the local site from other responsibilities, permitting it to focus its efforts on recovery.

The fire department contributed significantly to the recovery plan, set up temporary hose connections from hydrants to buildings, and directed and aided work crews in exercising valves and isolating leaks. Crews brought in to help station forces were diverse and included PWC San Diego, RNMCB Two, NMCB Three, Construction Battalion Unit 421, CBU 406, Amphibious Construction Battalion One, CBU 416, and a few sailors with construction trade skills who simply showed up to work.

Repair of the water system at Treasure Island and utility systems at other area bases would have taken much longer without their participation from the start.

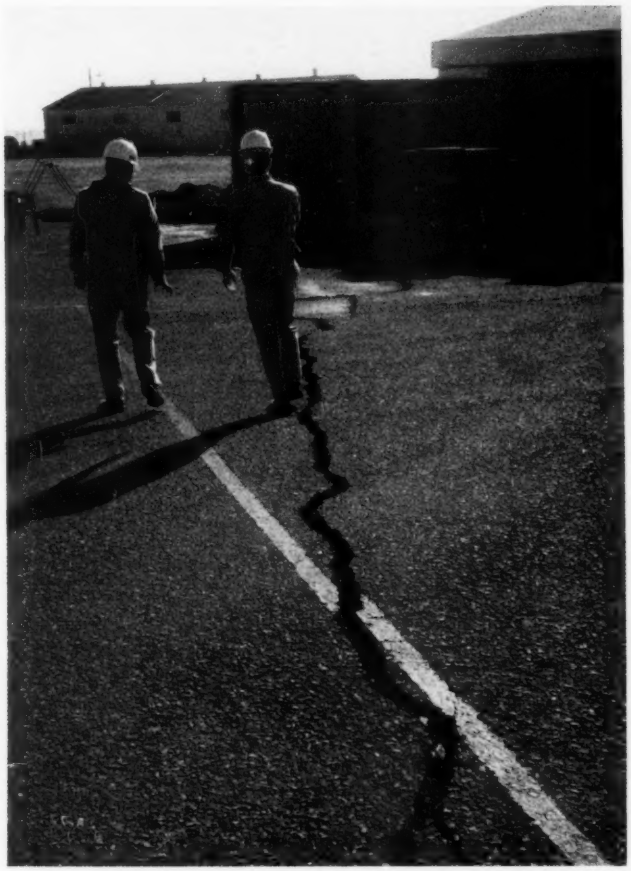
A repair plan was developed as the damage assessment continued. The repair plan operated on a system of repair chits. Each utility break had an

Fractured concrete at the base of the BEQ. Photo by LT Albert E. Spencer

assigned number and corresponding chit. As crews came in for more work they would be assigned a chit. As chits were assigned and completed, progress would be noted on the master map and called in to the Utility Control Center in Oakland.

Valves were exercised only on clearance from the local command center. This was the most organized way of assigning and tracking work, and it also provided the best audit trail.

The chits turned out to be invaluable months after the earthquake when statistics were correlated regarding the number of breaks, materials used and time frames of repairs.



A crack near the Naval Technical Training Command is inspected.
Photo by LT Albert E. Spencer

Lessons learned

Many lessons were learned from the earthquake as traditional ways of doing business were tested. Among these were:

- Maintain utility plans on site.

- Dedicate space for the local PWC command center and provide adequate phone service and access to the PWC, security, staff civil engineer and fire radio frequencies.

- Keep more sandbags and sand on the island. Sandbag filling chutes made during the recovery were kept.

- Keep duplicate keys for all heavy equipment and vehicles on the station.

- Maintain a minimum amount of construction equipment on the station at all times.

- Maintain emergency directions for operating the valves and pumps at the reservoirs on site.

- Install portable generator connections at all sewerage lift stations.

- Establish emergency job order numbers to be automatically activated in an emergency.

- Keep emergency gear (barricade tape, flashlights, pavement paint, and tools) in all supervisor vehicles.

- Install points of connection for temporary water service to important buildings.

- Establish definite work shifts as soon as possible after the earthquake. People started burning out at about nine days.

- Start stress counseling for recovery workers after the emergency.

- Make sure personnel know assembly areas for recall to the island.

- Maintain sufficient spare radio batteries on the island.

- Maintain a supply of fire hydrant fittings in the shop.

Disaster plans

In retrospect, Treasure Island recovery workers did a good job responding to and recovering from the earthquake. There were no fires or major injuries. The work force had been around for some time, knew the island well and worked well as a team.

Disaster preparedness plans are important. As a minimum, the plans should include a listing of available assets and delineate lines of responsibility and authority. Disaster plans in the San Francisco area are being corrected and updated as a result of the practical experience gained by those involved with the recovery efforts. ❑

The Oct. 17,1989, Loma Prieta Earthquake: Effects on Naval Installations

By CDR Mark A. Pickett, USNR
John A. de Becker
N. Terry Greiner
Eldon M. Jemtrud
J. Richard Faris
William F. Arent
Gary W. Ung
Paul M. Ko

On Oct. 17, 1989, an earthquake measuring 7.1 on the Richter scale rocked north central California. The epicenter of this earthquake was located about 60 miles southeast of San Francisco, near a mountain peak called Loma Prieta in the Santa Cruz Mountains. As a result of this brief event, two naval stations suffered moderate damage.

In general, naval installations in the San Francisco Bay area received little damage because of the Loma Prieta earthquake. However, Naval Station, Treasure Island and Naval Air Station Alameda did experience some moderate damage due primarily to ground settlement.

Differential ground settlement at both stations caused severe damage to concrete slabs and pavements supported by the ground. Pavement damage also occurred on the runways of NAS Alameda, drastically affecting aircraft operations. Differential ground movement also caused many breaks in the water and sewerage systems at both stations.

Typical sand boil in shoulder of a taxiway at NAS Alameda. This sand boil, near Taxiway 1, is about 6 inches deep.

Treasure Island

Treasure Island is a man-made island located in San Francisco Bay near the middle of the San Francisco-Oakland Bay Bridge. The island was constructed in 1936 to 1937 by hydraulically pumping sand fill dredged from the Bay bottom nearby into a staged, rock fill dike enclosure (a seawall). The above water area of the island is approximately 400 acres, 4,200 feet wide and 5,520 feet long. The island generally consists of 30 feet to 40 feet of silty sand fill overlaying 8 feet to 10 feet of medium dense sand and approximately 20 feet of soft to medium stiff grey silty clay (young Bay mud). The young Bay mud is underlain by layers of stiff clay (older Bay mud) and medium dense sand. The depth to bedrock varies at a steep slope across the island. At the southern end, near the rock outcrop island called Yerba Buena, the depth to bedrock is about 120 feet whereas the depth is more than 300 feet at the northern end. Ground water is typically found at a depth of 6 feet to 8 feet.

CDR Mark A. Pickett is an associate professor of civil engineering at the University of Toledo in Ohio. He has a Ph.D. and is a P.E. He wrote this article as part of his Naval Reserve duty. Co-authors John A. de Becker, Eldon M. Jemtrud, and J. Richard Faris are structural engineers at the Western Division, Naval Facilities Engineering Command in San Bruno, Calif. William F. Arent, N. Terry Greiner, Gary W. Ung, and Paul M. Ko are geotechnical engineers at WESTDIV.

Buildings Two and Three

Buildings Two and Three are similar hangar buildings which were constructed about 1938. Each building has eight bays, each bay consisting of a three hinge steel arch supported on deep piles.

Both buildings have one- or two-story additions attached to the main structure. These additions are supported by spread footings or by floor slabs-on-grade. The foundation characteristics of these additions are different than those of the main building. Consequently, the earthquake caused significant (3 inch to 6 inch) differential settlement between the main structures and the additions. This caused nonstructural wall joints between the main buildings and the additions to crack.

Both buildings have east and west side closure walls, which are supported differently than the pile founded steel arches. These closure walls are cavity walls constructed with a wooden or steel truss. The walls have an exterior stucco facade. In the wooden truss cavity walls of both buildings, the exterior surfaces of the walls are supported by slabs-on-grade, while the inner walls are supported by a section of floor slab which rests on a pile supported arch tie beam.

In the cavity walls of both buildings, several of the vertical timber members which support the lath-stucco wall were damaged by the earthquake. These members split as much as 3 inches at the location of the bolt connection to the K-bracing. This splitting was caused by the differential settlement between slab-on-grade supported appendage buildings (which supported the exterior wall) and the pile supported slab (which supported the interior wall). These walls will be demolished and replaced with walls which are structurally isolated from the main structure. This will eliminate the possibility of distress in future earthquakes as a result of differential settlement.

Axial split in vertical timber members which support the lath-stucco exterior wall of the west cavity wall of Building Two, Treasure Island.

In both buildings, several diagonal steel braces suffered inelastic buckling. They will either be replaced or strengthened as necessary.

Both buildings have many areas with differential settlements of 1/4 inch to 5 inches at slab joints. These are tripping hazards. Additionally, many slabs have differential settlement across their own width, creating a waviness or slant in individual slabs. Slab removal, subgrade excavation and recompaction, and new slab placement is likely to be expensive and ineffective in improving performance. Consequently, at the slab joints which are tripping hazards, the slab surfaces will be mechanically prepared, the slab perimeters will be sawcut, and concrete overlayment patches will be applied. This will provide a smooth transition surface with a slight slope.

Other facilities

The brig, which was under construction at the time of the earthquake, received minor damage. Many floor slabs settled or had minor cracks. Many door and window frames became misaligned because the uncompleted structure was not yet tied together. The southeast masonry block wall cracked. This minor structural damage will be repaired by shimming the door and window frames. The floor slabs can be repaired by injecting epoxy cement into the cracks and the slabs will be made level by grinding the tops of the slabs and applying a new layer of concrete. The cracked portion of the southeast wall can be repaired by replacement of the damaged section with new reinforced concrete masonry units.

Building Seven is a two-story L-shaped wood frame structure built about 1940. The ground floor is a concrete slab-on-grade. Its wooden framing system did not adequately transfer lateral loads to the foundation. About 75 percent of the ground floor settled approximately 1/4 inch to 1 inch. In one area, the floor settled about 6 inches and came in contact with the sunken foundation of a prior structure. This caused significant large cracks in the floor slab of the current structure and due to liquefaction, sandy mud flowed into the building through the cracks. This portion of the floor slab and the sunken foundation will be removed.

Some floor slabs and the wood walls in other portions of the building were damaged so significantly that structural survivability in future quakes is questionable. These wall and floor systems will be replaced and tied together to provide a structure which can better resist lateral loads during future earthquakes.

A few housing units were made uninhabitable due to cracks in interior walls and 2 inch cracks in the floor slabs. These units will be made habitable by replacing cracked wallboards and floor slabs as necessary.

Utility lifelines, causeway and seawall

Differential ground motion and ground cracking caused many breaks in the sewerage lines; this made the sewerage system inoperable for sev-

Large crack caused by 6 inch settlement of the floor slab and subsequent contact with the sunken foundation of a previous structure, Building Seven, Treasure Island.

eral days. Within 100 feet to 300 feet of the east seawall, long cracks appeared near a pre-historic river bed, where bay mud thickness is the greatest.

During and immediately after the earthquake, many sand boils appeared. The wide distribution of these sand boils, and other evidence throughout the island, indicate that soil liquefaction occurred in many areas. (Liquefaction is a phenomenon where loose saturated sandy soils of near uniform grain size lose most of their strength due to sustained shaking.)

The perimeter road on top of the seawall and the seawall suffered noticeable damage, including 2 inch to 4 inch depressions and cracks. In these locations, there was evidence of both horizontal and vertical motion of the seawall. At the northern end of the island, the road settled 1 foot to 2 feet over a 50 foot by 20 foot area.

Small but measurable movement continued in the distressed northern area of the seawall for a period of about six weeks after the earthquake. The greater settlements in the distressed sections of the north and west seawalls, compared to other areas in the seawall, may have been caused by the greater width (and hence weight and depth of fill) of the seawall in those areas, compared to the remainder of the seawall.

The cracks in the seawall do not present any immediate danger. They will be filled and sealed with coarse sand, dry granular material, and cement. Grading of ground surface areas inside of the wall will be corrected to drain water away from the toe of the slope.

Most of the island's soil has settled as a result of the earthquake. In the northern and western portions of the island, the total settlement during the first five months after the earthquake was about 1 foot. Since the ground water level was close to the surface before the earthquake, this settlement has resulted in the appearance of surface puddles during the monthly high tide.

Typical crack in pavement at NAS Alameda. Note sand residue left as a result of liquefied soil seeping through crack.

To monitor the condition of the seawall and Treasure Island, a baseline of elevations at various locations on the seawall and on the island have been established with respect to a stable reference point on Yerba Buena Island. These elevations will be monitored semi-annually. Additionally, the topography and soil conditions around the seawall were surveyed. Detailed analysis of this data is currently underway.

After the earthquake, several long cracks appeared in the causeway joining Treasure Island to Yerba Buena. These cracks continued to grow in width and length for about three days. The causeway was constructed at the same time and in the same manner as Treasure Island. The concern for the

stability of the causeway is because it is the only road to the mainland and because many utility lifelines which serve the island are buried in the causeway. Post-earthquake geotechnical surveys and slope stability analyses were performed for the causeway. The results of these studies indicate that under earthquake loading or as a result of liquefaction, displacements in the causeway embankment are likely to occur. As a result, additional evaluation was undertaken to recommend methods for improving future performance of the causeway. Possible improvement methods include soil densification by grouting or vibroplaced stone columns, stabilization by deep soil mixing, or construction of various structures to limit the deformation of the embankment.

Naval Air Station Alameda

NAS Alameda is located on the northeast coast of San Francisco Bay, a few miles south of the San Francisco-Oakland Bay Bridge. The western portions of the station were constructed of hydraulically placed sand fill, which was contained by rock seawalls. Large areas of the sand fill liquefied and settled during the earthquake. The airfield occupies this portion of the station and thus it suffered the worst damage. Most of the buildings of the naval air station are founded on piles and they experienced only minor damage, such as settlement of steps, sidewalks and appendages. There was also some damage to the water and sewerage systems due to differential ground settlements.

Airfield, air terminal and pier damage

Both runways 13-31 and 7-25 and two taxiways suffered significant surface damage and were closed to aircraft operations. This damage consisted of pavement cracking and differential settlement caused by soil

Earthquake Hazard Mitigation Philosophy

The Navy, along with the other branches of the Department of Defense, has for many years considered the consequences of earthquakes on military facilities. This concern has resulted in a series of technical manuals, including the tri-services manual *Seismic Design Guidelines for Essential Buildings*.* This document implements the earthquake hazard mitigation philosophy of the international earthquake engineering community. This accepted philosophy on seismic design criteria could be stated as follows:

- Structures which will not serve any post-disaster recovery functions are designed so that no life-threatening situations will arise as a result of the worst plausible earthquake which could occur, during the life of the structure, at the site where the structure will be built. Thus these structures are designed to sustain:
  - Major damage (without collapse) during a major earthquake
  - Minor (repairable) damage during moderate earthquakes
  - No damage during minor earthquakes
- Structures which must remain operational during and after the disaster are designed to sustain minor (repairable) damage during the worst earthquake which can be reasonably expected to occur at that site during the life of the structure. This damage must not impede the function of the structure.

The results of the Loma Prieta earthquake must be viewed in light of these design criteria. Consequently, the moderate damage to facilities and the interruption of normal services and operations experienced by Bay Area naval installations should be considered as an expected response to any moderate earthquake. ❑

**Seismic Design Guidelines for Essential Buildings*, Departments of the Army (TM-5-809-10-1), Navy (NAVFAC P-355.1), and Air Force (AFM 88-3, Chapter 13), February 1986.

liquefaction. The taxiways which were closed to aircraft operations were constructed with asphalt concrete (AC) and Portland cement concrete (PCC) pavement. Due to soil liquefaction and settlement, there was cracking of many AC surfaces and opening of PCC pavement at slab joints. Several cracks showed a loss of bond between the new AC surface and the underlaying AC surface. In many areas, the runway shoulder pavement heaved and settled. Two sand boils were found in the shoulder area at the southeast corner of the intersection of the two runways. Many aprons constructed of PCC were extensively damaged by settlement. These areas remain closed to aircraft operations.

A 3,300 foot portion of Runway 13-31 was closed to aircraft traffic due to AC pavement cracks up to 4 inches wide and differential slab settlements up to 4 inches. Several of these cracks extended 3 feet to 5 feet deep into the ground. One week after the earthquake, six large sinkholes developed in a line starting in the shoulder and extending across the runway. These sinkholes were about 6 feet wide and varied in depth from 4 inches to 3 feet.

Along Runway 7-25, a 3,000 foot section was closed to aircraft operations. Cracks up to 2 inches wide and differential slab settlement up to 2 inches were observed in the AC pavement. Sand boils which were as high as 8 inches were observed at these cracks. The first 200 feet of PCC at the 25 end of the runway suffered extensive crack damage at slab joints. This area was replaced.

Taxiway Six had cracks which were 3 inches wide and had 8 inch high sand boils.

AC pavement cracks 1/2 inch to 2 inches wide were repaired by grinding out sections 3 inches deep by 18 inches wide, placing a reinforcement fabric on the section, and laying new AC pavement. Smaller cracks were filled with clean sand and sealed with 1401 joint sealant. Areas of AC pavement with major cracking and differential vertical settlement were repaired by cutting out 12-foot wide sections. In each section the subgrade was recompacted, a new 12-inch aggregate base was layed and new AC pavement was placed.

The air terminal building was constructed on piles. But several one-story buildings attached to the air terminal were founded on spread footings. Due to these different foundation characteristics, the earthquake caused differential settlement between the air terminal and its attached buildings and staircases. Consequently, several large cracks occurred between the terminal and its attachments.

In general, the pier area suffered only minor damage, although a catwalk between the end of Pier 2 and a mooring platform dropped into the water. This occurred due to a 12-inch differential movement between the pier and the mooring platform.

An 8-inch high sand boil with adjacent sinkhole at NAS Alameda.

Conclusions

The Oct. 17, 1989, Loma Prieta earthquake caused some damage to naval installations. This damage should be considered as an expected response to any moderate earthquake. Although several safety hazards were created, no life-threatening situations occurred as a result of this earthquake. The Loma Prieta earthquake was not as large as a design basis earthquake. The lessons learned from the Loma Prieta earthquake can assist military facility engineers in designing for and recovering from future earthquakes.

Acknowledgement

This report is a condensation of many reconnaissance and damage investigation reports prepared by the authors and numerous other individuals on the staff of the Western Division, Naval Facilities Engineering Command, San Bruno, Calif. This report was compiled during a Naval Reserve training period of the senior author, and the authors wish to acknowledge the efforts of several personnel who made this USNR training period possible: Commander R.F. Krochalis, WESTDIV; Captain W.L. Penn, commanding officer, Naval Reserve COMSUBLANT DET 305, Cleveland, Ohio; and Lieutenant Commander R. Walton, Naval Reserve Readiness Command Region Five, Ravenna, Ohio. ❑

A Seabee's Diary of the Great Earthquake of 1989

By LT Paz Gomez Allen, CEC, USN

Tuesday, October 17, 1989

Today was an exciting day. Naval Construction Battalion Unit 416, at Naval Air Station Alameda, and the rest of the San Francisco Bay area was shaken by a 7.1 magnitude earthquake just after 5 p.m. The CBU building shook like a roller coaster for about 15 to 20 seconds.

As a result of the earthquake, the CBU building sank about 4 or 5 inches in the back, jamming the rear door. Water was everywhere, and the sidewalk cracked. Thank goodness no one was hurt.

After the initial shock, the master chief, chief, and I drove around the naval air station to see if we were needed to assist with any emergency rescue efforts. The damage looked major, so a 100 percent recall of the Seabees was conducted by Public Works Center San Francisco Bay. Within minutes of a request from the Oakland Police Department for assistance, the whole unit was in full uniform with tools in hand and heavy construction equipment in tow on its way to the most tragic site hit by the earthquake—Interstate 880. Two large overpasses collapsed, one on top of the other. There were more than 12,000 tons of concrete and steel supported by weakened columns. It was a delicate structure that could topple over with a strong aftershock.

LT Allen is the officer in charge of Naval Construction Battalion Unit 416. She is a registered professional engineer in California.

"The difficult we do at once, the impossible takes a bit longer," says it all about the Seabees.

The Seabees were raring to go. After 10:30 p.m., we returned to our homes, although some of the Seabees were willing to stay longer, to get some rest for tomorrow's disaster recovery efforts.

Wednesday, October 18

All the radio and television stations were talking about the GREAT QUAKE.

The PWC called to assess the CBU's excavating capabilities. PWC also contacted other Seabees located throughout southern and central California to request equipment and manpower support. Seabees started coming from all over.

A 91-man air detachment from Naval Mobile Construction Battalion Three was rerouted from a field exercise at Fort Hunter Liggett with their full table of allowance in tow. About 17 of the Seabees arrived today with the detachment's assistant officer in charge, Ensign Bob Gallen, CEC, USN. They camped out in the CBU's backyard.

The commanding officer of NMCB Three, Commander Charles Kubic, CEC, USN, and several other officers from NMCB Three came from Port Hueneme to help assess the damage.

CBU 406 from NAS Lemoore was also on its way with heavy equipment to the Bay Area to help with disaster recovery at the naval supply center at Oakland. The OIC, Lieutenant (junior grade) Darius Banaji, CEC, USN, brought 27 men with him.

Shortly before midnight, the Seabees of Amphibious Construction Battalion One of San Diego started a convoy with 17 pieces of rolling stock. Lieutenant Lee Ellsworth, CEC, USN, was the OIC for the 43-man det that convoyed 19 hours to assist in recovery efforts at NSC Oakland.

CBU 421, under the guidance of OIC Lieutenant Mark Bergin, CEC, USN, from Mare Island, was already assisting in the rescue effort at Naval Station Treasure Island. The Seabees of CBU 416 were hard at work at NAS Alameda getting the water, gas, and steam services back on line.

All the Seabees were putting in the long hours and seemed glad to be helping out. It was encouraging to see disaster recovery training being used. When Seabees have to mobilize, they really CAN DO!

Thursday, October 19

Another day evaluating earthquake

damage. NMCB Three and CBU 416 representatives assessed the runway damage. Most of the damage looked like it was within the capability of Seabees to repair. The final 1,500 to 2,000 feet of runway will need major work by civilian contractors.

Repairs to restore water continued. The rest of the NMCB Three air detachment arrived and set up camp at NAS Alameda. Three will do repair work at NAS Alameda and Treasure Island.

Pier Two at NAS Alameda will need major repairs. Underwater Construction Team Two from Port Hueneme will investigate and assist under the direction of Lieutenant Commander Mark Samuels, CEC, USN.

Friday, October 20

Seabee morale was still high, although they were starting to get tired. Emergency repairs should be resolved soon.

Some of the water was turned on at NAS Alameda. Water continued to be a problem at Treasure Island. NMCB Three will take their shower tent to Treasure Island for local residents to use. They haven't had water for three days.

Saturday, October 21

Things were coming together. There was water in most of NAS Alameda. Water buffaloes were still around in all major locations, including housing and the commissary. The exchange, mini-mart, gas station, commissary, and other support facilities were opened. Things were starting to get back to normal.

Utility lines were still down at Treasure Island. The OIC of the NMCB Three Air Detachment, Lieutenant John Bergstrom, CEC, USN, sent a detail to Treasure Island to put up the shower tent. Seabee reservists from Reserve Naval Mobile Construction Battalion Two filled sandbags for the seawall area.

It rained. Without breaking stride, the Seabees put on their ponchos and continued to work.

Sunday, October 22

Things settled down. The Seabees of ACB One even planned a game of softball for those whose 12-hour shift was over. Unfortunately, the weather turned bad. The Seabees continued to work despite the rain.

Monday, October 23

The progress continued. PWC determined most of the Seabees will depart by this Friday.

Tuesday, October 24

A week after the earthquake, routine schedules for the CBU were beginning to return.

Tuesday, October 31

It has now been two weeks since the earthquake. The Seabees of NMCB Three left last Thursday, ACB One left last Friday, and CBU 406 left today.

The local Seabees will take care of the remaining fix-up projects. CBUs 416 and 421 will continue working on housing repairs at Treasure Island, and CBU 416 will continue their work at NAS Alameda.

CBU 416 also provided community assistance to the Federal Emergency Management Agency office in Sunnyvale. Electricians installed electrical outlets for the office equipment FEMA needed to help the victims of the quake.

Another crew headed to San Francisco to bring a warehouse building up to acceptable standards so civilians left homeless by the earthquake can move into it. Some of the homeless have been living aboard the USS *Peleliu* (LHA 5).

In the face of a major disaster, the Seabees of CBU 416 and other units pulled together as a team. CBU 416 Utilities Master Chief Del Thompson, Equipment Operator Chief Bob Allen, and Builder Chief Rick Kemper worked long hours coordinating repair efforts and continuously provided guidance to the junior Seabees.

The saying, "The difficult we do at once, the impossible takes a bit longer," says it all about the Seabees. ❑

Seabees from CBU 416 work frantically to secure and repair a 12-inch water main servicing the north side of NAS Alameda after the earthquake.

Photo by George Champagne

Changing Times for Individual Sureties: The New FAR Provisions

By Karen L. Borell

You open the bids for an important project and discover that the low bidder has two individual sureties, I. M. Rich and I. M. Rich II, guaranteeing the bid. Each surety claims to have a net worth of more than $50 million, with holdings concentrated in a company with a soon-to-be-patented process of extracting gold from sea water. "Can't miss," financial consultant Flybynite Inc., says, in the two inches of supporting documentation.

Here we go again.

"But wait," your contract specialist says, "haven't the new Federal Acquisition Regulations provisions changed all that?"

It may be too early to say the game is over, but the new FAR provisions, effective Feb. 26, 1990, have changed all the rules.[1] Every contracting officer who works with bonded contracts should become familiar with these changes. It will save your office time and money. (For checklist, see accompanying article.)

Briefly, the new FAR 28.203 requires that an individual surety put up a specific piece of property for a bond and give the government a recorded security interest in that property. Acceptable property is only real estate, stocks traded on national exchanges, cash or cash equivalents, and government securities. Title and value of the real estate must be proven by certificates and appraisals from companies that have been approved by the U.S. Department of Justice. Stocks, cash and other property must be placed in escrow with federally insured financial institutions.

Unacceptable assets include foreign real estate, the personal residence of the surety, real property interest that is not a solely owned fee simple (except where all cotenants agree), mineral rights, stocks or bonds not publicly traded on one of the specified national stock exchanges, partnership interests, or personal property such as furs, jewelry, coin collections and copyrights.

The changes in the FAR are the result of widespread fraud that has permeated the provision of individual sureties in the last few years and the attention the problem has attracted. Members of Congress have received complaints from ruined subcontractors and contractors unable to get bonding. The Government Accounting Office has become aware of the agency problems in the course of reviewing the bid protests.[2] Virtually every federal agency with construction procurement has a story to tell about defaulted contracts with nonexistent or unreliable sureties, defaulted takeover contracts, and unpaid subcontractors and unreimbursed reprocurement costs. After a series of these problems came to light, the GAO issued several decisions establishing that the contractor had the burden to justify the representations of the surety's net worth.[3]

Contracting officers frequently discovered that claimed assets did not exist at all. When documentation became required for the representations on the SF-28 (Affidavit of Individual Surety), it became commonplace for documentation to be submitted showing ownership of assets that were difficult to value and for which it was even more difficult to verify value. Reviewers rejected sureties that could not produce independent, verifiable credible evidence of the existence and value of assets, as well as those for which the value of the assets was too speculative. As few standards have been specified for acceptability of assets and evidence, surety review has been lengthy, and has been subject to the vagaries of time and the expertise available to the contracting officer.

Even when an individual surety has sufficient net worth to support a bond, the government's recovery would be uncertain if collection were necessary. The government's claim to any assets would be ineffective against other creditors without knowledge of the bonds who collect their claims before the government files suit. Several years may elapse between the time the bond is accepted and when the government attempts to collect against a surety. During this period, there is nothing to prevent a surety from transferring its assets nor to prevent a levying judgment creditor from executing on the property.

Determining if the proposed individual surety is overextended in bond obligations is difficult. It is not unusual

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Bonds With Individual Sureties Under the New FAR Provisions: What to Look For

Are the individuals acceptable?

• Check the debarment list. Individual sureties may be debarred for wrongful acts as sureties. FAR 28.203-7.

• Note the number of sureties. The contractor may now use as few as one or as many as three, so long as each is jointly and severally liable for the full amount of the bond and the pledged assets, when combined, equal or exceed the penal amount of the bond. FAR 28.203(b).

Have they provided the right documents?

• Note that SF-24, SF-25, SF-25-A (bond forms), and SF-28 (Affidavit of Individual Surety) have been revised, and new forms (Optional Forms 90 and 91) have been created for escrow and lien releases.

• The bond package must include the bond(s), SF-28(s), and the pledge documents (usually real estate liens and/or escrow agreements). FAR 28.203-1. The pledge documents must be effective, and recorded (if real estate is pledged), by the time and date of bid opening for bid bonds. Pledge documents for performance and payment bonds must be effective and recorded (for real estate) before award.

• Format for acceptable real estate liens is found in FAR 28.203-3(d).

for a contracting officer to painstakingly investigate a surety's assets, conclude that the individual does have some property of substantial value, and then learn that other outstanding bond obligations greatly exceed the individual's net worth. As there is no central clearinghouse for information on bond obligations, the contracting officer discovers this overextension of obligation only if he or she is part of the informal network of federal employees who work in this area, or if another surety broker, wanting to spoil a rival's business, discloses the surety's other obligations. Moreover, even though a contracting officer may get some information about other federal bond obligations, many of the proposed sureties also have bond obligations for counties, cities, school districts, etc., that are difficult, if not impossible, to uncover.

Over-obligation may result from any number of actions by the surety brokers or the individual sureties themselves. Individual sureties often sign and submit large numbers of incomplete SF-28s. Occasionally the lines where one is to indicate value of assets debts, and net worth (SF-28 lines 7a - 7g) are left blank by the surety for the broker to fill in later. More commonly, the line indicating the form for which the contract is being submitted (SF-28 line 12) is left blank. The surety signs 20 or 30 forms, all on the same day, each one indicating on line 10 that there are no other bond obligations. A different contract number is filled in on each form. The forms are then sent to the respective contracting officers. The surety and the broker can claim there was no misrepresentation of bond obligations because when the SF-28 was signed, there were no other obligations.

The Western Division of the Naval Facilities Engineering Command takes one of two positions on this practice, depending upon the situation. The first is that the bond is defective because the individual surety has no intent to be bound as a surety on the contract if that contract was not referenced on the SF-28 when it was signed. Alternatively, this office assumes that the surety is participating in a fraud by enabling someone to use the signed SF-28 to misrepresent material facts. This problem is compounded because many individual sureties work with more than one broker, and neither the individual surety nor the brokers may know all of the outstanding bond obligations.

Often the line where one indicates other outstanding bond obligations (SF-28 line 10) is blank when the surety signs the form. Perhaps the individual signs the form with the agreement on the part of the broker that the rest of the form will be properly completed before submission. In this case the signed form is merely a business convenience used to avoid a flurry of paperwork exchanges when a contractor needs bonds quickly. The broker's position is that the likelihood of the assets actually being called upon for an obligation is remote. The broker may argue as follows: For bid bonds, the contractor may or may not be the low bidder. For performance and payment bonds, the bonds may or may not be accepted. Even if the bonds are accepted, there is no call on the assets if there is no default. Even if there is a default, the broker can provide a takeover contractor for the surety. No harm, no foul.

Although the FAR has prohibited this practice, the prior regulations had no mechanism to preclude it. There are three objections to this approach.

• It is prohibited by regulation and by GAO decisions that require each individual surety must have sufficient net worth to cover all outstanding bond obligations. All obligations for which the surety has been proposed must be disclosed.

• The broker and/or the surety are, in effect, engaged in the business of insurance without the licensing and oversight of any insurance regulatory authority.

• The integrity of federal procurement is compromised by including in the bidding contractors without the financial backing required.

Advantages of the new FAR provisions

Clear standards are established.

By specifying the types of property that may be pledged and the evidence required, the surety, the contractor and the broker have clear guidelines about what to submit. Under prior regulations, a considerable amount of documentation was required. Providing this documentation became burdensome, expensive and an invasion of personal privacy. Previous practice required the contracting officer to determine the individual's personal financial net worth. To make such a determination, the government typically requested a certified public accountant's review or audit, personal income tax returns, personal credit reports and other financial information.

The new FAR provisions eliminate the need for most of this documentation. The contracting officer's discretion is reduced, presumably resulting in fewer opportunities for bidders to claim that discretion has been abused. Much less time will be needed to review contractor responsibility, resulting in savings both to the government and to the contractor. Reviews of bonds with individual sureties will be limited to whether property in the specified categories is being pledged and whether the pledged documents create legally enforceable liens.

The government's interest is protected.

The government will have a prior claim on property by lien or escrow, so it will not lose out to later claims by other creditors. Other creditors will not be misled because the records will clearly indicate the surety's obligation to the government. Most property that would be exempt from collection actions under state homestead protection law is excluded, so the contracting officer need not determine how a legally enforceable lien may be placed on homestead property such as a personal residence.

Over-obligation avoided.

The problem of over-obligation should disappear because the documents required will show whether any of the property is encumbered by other obligations. Many agencies have called for, or tried to establish, a central clearinghouse for information regarding sureties. The new provisions eliminate the need for this addition to bureaucracy. The individual surety will be better protected and better informed because it will be impossible for that surety to become purposely or inadvertently over-obligated on bonds.

Conclusion

The opportunity for fraud and the risk of loss to the government and subcontractors is significantly reduced. The new FAR provisions provide safeguards for the government, the contractors, the sureties and the subcontractors. The contracting officer has one less headache. ❑

References

[1]Brokers and contractors have mounted an effort to change the new regulations. Rep. Cardiss Collins, 7th District, Illinois, introduced H.R. 4179 on March 6, 1990. This bill would require acceptance of individual sureties that are members of an approved surety association.

[2]See United States General Accounting Office, Individual Sureties Used to Support Federal Construction Contract Bonds, B-235444, October 1989.

[3]Enclave One, Inc.; Ward Jones Construction Co., B-232383, B-232383.2, Nov. 17, 1988, 88-2 CPD 488; Cascade Leasing, Inc., B-231848.2, Jan. 10, 1989, 89-1 CPD 20.

What assets are acceptable?

- Cash, certificates of deposit, or other cash equivalents with a federally insured financial institution. FAR 28.203-2(b)(1).
- U.S. government securities. FAR 28.203-2(b)(2).
- Stocks and bonds actively traded on a national U.S. security exchange with certificates issued in the name of the individual surety. FAR 28.203-2(b)(3).
- Real property that is located in the U.S., its territories or possessions; solely owned in fee simple by the surety (without any form of concurrent ownership unless all cotenants agree to pledge the property); and not the principal residence of the surety. FAR 28.203-2(b)(4) and (c)(3).
- Irrevocable letters of credit issued by a federally insured financial institution in the name of the contracting agency and referencing the solicitation or contract number. FAR 28.203-2(b)(5).

What assets are not acceptable?

- Notes or accounts receivable. FAR 28.203-2(c)(1).
- Foreign securities. FAR 28.203-2(c)(2).
- Any interest in real estate that does not meet the description above, such as no life estates, leases, trusts, deeds of trust and future interests. FAR 28.203-2(c)(3).

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What to Look For...

Continued from page 29

• Any personal property that is not listed above, including furs, antiques, jewelry and copyrights. FAR 28.203-2(c)(4).

• Stocks and bonds of the individual surety in a controlled, affiliated or closely held concern of the offeror/contractor. FAR 28.203-2(c)(5).

• Assets belonging to a corporation or partnership, i.e., not solely owned by the surety. FAR 28.203-2(c)(6).

• Speculative assets, such as mineral rights, stock options, puts and calls, and commodities futures. FAR 28.203-2(c)(7).

• Assets of the contractor.

• Anything else that does not fall strictly within the categories described as acceptable. FAR 28.203-2(c).

What evidence of existence and value of assets should you get?

Real estate

• Evidence of title—A current certificate of title prepared by a title insurance company approved by the U.S. Department of Justice, showing fee simple title vested in the surety (or cotenants if all agree, and if so, copy of said agreement), and whether there are any other recorded encumbrances. FAR 28.203-3(a)(1).

• Current evidence of amount due under any encumbrance. FAR 28.203-3(a)(2).

• Copy of current real estate tax assessment or current certified appraisal prepared by professional appraiser. FAR 28.203-3(a)(3).

Cash, C.D.s, cash equivalents, stocks, bonds, government securities

• Escrow account agreement with federally insured (FDIC) financial institution with following terms.

• Contracting officer has sole and unrestricted right to draw on funds upon written demand.

• Funds released to anyone else only on written authorization of contracting officer.

• Government not responsible for any costs for account.

• Contracting officer provided regular account statements from institution.

• Institution not responsible for interpreting contract. In event of dispute with contractor, subcontractors, suppliers, surety, etc., institution required to disburse funds to government unless court order says otherwise.

And

• Terms cannot be amended without government approval. FAR 28.203-1(b)(1).

• In addition, for stocks and bonds, evidence that the securities are traded on a national stock exchange (not OTC or NASDAQ), and evidence that they are issued in the name of the individual surety. FAR 28.203-2(b)(3).

• For government securities only, escrow agreement is not required if book entry notation agreement with depository institution. FAR 28.203-2(b)(2).

Irrevocable letters of credit

• Original letter of credit reciting all terms required. FAR 28.203-2(b)(5).

• Evidence that letter of credit is issued by a federally insured (FDIC) financial institution. FAR 28.203-2(b)(5).

How do you compute value of pledged assets?

• Real estate—One hundred percent of most recent tax assessment value minus encumbrances, or 75 percent of market value (if current appraisal provided) remaining after subtracting encumbrances. FAR 28.203-2(b)(4).

• Cash, C.D.s, cash equivalents—Face value. FAR 28.203-2(b)(1).

• Government securities—Market value. FAR 28.203-2(b)(2)

• Stocks and bonds—Ninety percent of 52-week low as reflected at time of submission of bond. FAR 28.203-2(b)(3).

• Irrevocable letters of credit—Face value. FAR 28.203-2(b)(5).

• Does net value of all surety assets pledged, minus other bond obligations, equal or exceed the bond obligation(s)? FAR 28.203-1(b).

• Legal concurrence on legal sufficiency of pledge documents? FAR 28.203(f). ❑

NCEL research engineer honored for development of new anchor technology

Development of a new anchor technology that will save the Navy $15 million over 10 years has earned an engineer at the Naval Civil Engineering Laboratory in Port Hueneme, Calif., an invention award of more than $21,000.

Robert Taylor, a senior research engineer in the Ocean Engineering Department, was honored June 28, 1990, during a special ceremony at NCEL. Rear Admiral David E. Bottorff, CEC, USN, commander of the Naval Facilities Engineering Command and chief of civil engineers, presented the award, citation and plaque.

Taylor's development of the NAVMOOR drag embedment anchor represented a technological breakthrough. Designed primarily for fleet moorings, the anchor has proven highly adaptable in a variety of other applications.

Robert Taylor (second from left) received an award of more than $21,000 for developing the NAVMOOR anchor. Also pictured are (from left) Dr. R.N. Storer, NCEL technical director; Taylor; RADM J.R. Ives, then-commander, Pacific Division, Naval Facilities Engineering Command; RADM D.E. Bottorff, NAVFAC commander and chief of civil engineers; CAPT P.A. Chapla, then-prospective commanding officer of NCEL; and CAPT D.R. Wells, then-commanding officer of NCEL. An experimental 100-pound model of the anchor is shown in the foreground.

It is less expensive to build, is stronger, works in all types of seafloors, holds more on a pound-for-pound basis, and is suited to a wider range of mooring leg configurations than existing Navy and commercial general purpose anchor systems. A family of six NAVMOOR anchors are being manufactured; the smallest is 100 pounds and the largest, 17,000 pounds.

A recognized international expert, Taylor has been employed by NCEL for more than 20 years, specializing in marine geotechnical engineering, anchors and moorings, buoy and cable systems, and portable breakwaters.

NCBCs win MWR awards

Congratulations to Naval Construction Battalion Center Gulfport, Miss., and NCBC Port Hueneme, Calif. They both received awards during the 1990 Navy Morale, Welfare and Recreation conference held in San Diego.

The NCBCs won the top two honors for overall excellence in recreational programs for medium size commands Navywide. NCBC Gulfport won first place and NCBC Port Hueneme won second place. The awards are presented by the Naval Military Personnel Command.

NCBC Gulfport also received the Secretary of the Navy's Three Star Accreditation Award for its Officers Club and a Four Star Award for its Chief Petty Officers Club and Enlisted Club; first place for Excellence in Golf Programming; and second place for Excellence in Child Care Programming.

Captain Herb Lewis, CEC, USN, NCBC Gulfport, Miss., then-commanding officer, won the Navy's 1990 Outstanding Military Leadership Award for support for recreation and club programs.

NCBC Port Hueneme also received first place for its Child Development Program and second place for its Youth Activities Program.

Seabees in Saudi Arabia

Here's a quick update on Seabees' participation in Operation Desert Shield as of mid-September.

On August 13, 1990, the first wave of Seabees arrived in Saudi Arabia. An element of Amphibious Construction Battalion One with 210 personnel, and their commanding officer, Commander Rich Haas, CEC, USN, was responsible for the successful off loading of U.S. Marine Corps equipment and supplies from the Military Prepositioned ships.

Our second wave of Seabees to arrive were personnel from Construction Battalion Units 411 and 415. The two CBUs under the leadership of Lieutenant Susan Globokar, CEC, USN, and Lieutenant Lynne Bever, CEC, USN, are part of Fleet Hospital Five. They are tasked to erect and and maintain the 500-bed facility.

On August 27, Captain Mike Johnson, CEC, USN, arrived in country with several members of his CBPAC Forward Element. Shortly thereafter, the air dets from Naval Mobile Construction Battalion Five from their homeport in Port Hueneme, Calif., NMCB Four from Camp Moscript, Puerto Rico, NMCB Seven from Camp Shields, Okinawa, and NMCB 40 from Camp Covington, Guam, arrived in country.

The bulk of the battalion's Table of Allowance (TA-01) is being moved to Saudi Arabia by sealift. The battalion's main body will deploy by air to join up with their equipment when it arrives in country. As expected, our Seabees responded to the call magnificently and were mobilized with full pack-ups and ready to depart for the Middle East in record time.

TQL update

The Naval Facilities Engineering Command continues to seek ways to improve its service to customers through Total Quality Leadership. Here's a quick update on what the Facilities Support Contracts Process Action Team (PAT) of the Quality Management Board for Facility Support Contracts at Headquarters has been doing.

The FSC PAT visited 22 sites including large and small public works offices. The PAT found that development of performance work statements frequently takes 18 to 24 months, and the entire FSC process takes up to three years to complete. Although there are acknowledged owners of "pieces" of the FSC process, ownership of the entire process is an issue. Lack of resources at the PWO level is also an issue.

Recommendations of the PAT for improving the way we do business include: establish a central program manager for the FSC process; make sure acquisition plan milestones are developed and agreed to by all parties; and consider combining resident officer in charge of construction and public works offices contracting resources into one central field contracting office.

Retiring soon?

Attention all retiring flag officers, captains and commanders. If you would like to continue to receive the *Navy Civil Engineer* magazine after your retirement, notify the magazine's editorial office so you can be added to the distribution list.

Send your address and date of retirement to Naval Facilities Engineering Command, Attn: Editor, *Navy Civil Engineer* Magazine (Code OODA), 200 Stovall St., Alexandria, Va. 22332-2300. Or call (703) 325-0310 or Autovon 221-0310.

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